

## CLAIMS

1. A plasma processing apparatus comprising:

an RF generator operable to output RF power;

an impedance matching network operable to receive the RF

5 power;

a plasma chamber operable to receive an output from the  
impedance matching network;

a storing unit operable to store information relating to  
an S parameter of the impedance matching network; and

10 a control unit operable to control an operating condition  
for the plasma chamber, based on the information relating to  
the S parameter.

2. The plasma processing apparatus of Claim 1, wherein

15 the information relating to the S parameter of the  
impedance matching network is at least one of the S parameter  
of the impedance matching network and a power transmission  
efficiency of the impedance matching network which is calculated  
based on the S parameter.

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3. The plasma processing apparatus of Claim 1, wherein

the impedance matching network is an automatic impedance

matching network which, when impedance mismatch occurs between the impedance matching network and the plasma chamber, detects the impedance mismatch, and adjusts a variable capacitor included in the impedance matching network, to achieve impedance match between the impedance matching network and the plasma chamber.

4. The plasma processing apparatus of Claim 1, wherein  
the S parameter of the impedance matching network is  
10 measured using an RF network analyzer.

5. A control method for a plasma processing apparatus in which  
RF power is supplied by an RF generator to a plasma chamber  
through an impedance matching network so that plasma processing  
15 is performed in the plasma chamber, wherein  
a power transmission efficiency from the RF generator to  
the plasma chamber is calculated based on an S parameter of  
the impedance matching network, and  
a control unit of the plasma processing apparatus controls  
20 the plasma chamber in reference to the power transmission  
efficiency.

6. The control method of Claim 5, wherein  
the S parameter of the impedance matching network is S21  
which is a forward transmission parameter.

5 7. The control method of one of Claims 5 and 6, wherein  
the RF power supplied by the RF generator is controlled  
in reference to the power transmission efficiency.

8. An evaluation method for a plasma processing apparatus in  
10 which RF power is supplied by an RF generator to a plasma chamber  
through an impedance matching network so that plasma processing  
is performed in the plasma chamber, wherein  
an RF network analyzer is used to measure an S parameter  
of the impedance matching network, and  
15 a power transmission efficiency from the RF generator to  
the plasma chamber is calculated based on the measured S  
parameter.

9. The evaluation method of Claim 8, wherein  
20 the S parameter of the impedance matching network is S21  
which is a forward transmission parameter.

10. The evaluation method of one of Claims 8 and 9, wherein  
an amount of power the plasma chamber receives is obtained  
based on the power transmission efficiency.

5 11. The evaluation method of one of Claims 8 and 9, wherein  
when  $\eta$ , RL and Rm respectively denote the power  
transmission efficiency, a real resistance in the plasma chamber,  
and a real resistance in the impedance matching network,  
 $Rm = (RL/\eta) - RL$ .

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12. An evaluation method for a plasma processing apparatus in  
which RF power is supplied by an RF generator to a plasma chamber  
through an impedance matching network so that plasma processing  
is performed in the plasma chamber, wherein

15 an RF network analyzer is used to measure an S parameter  
of the impedance matching network, and  
a matching impedance is obtained using a matching network  
function of the RF network analyzer.

20 13. An evaluation method for an impedance matching network,  
wherein

an S parameter of an impedance matching network is measured,

and converted into a power transmission efficiency  $\eta$  of the impedance matching network, and

when  $R_L$  and  $R_m$  respectively denote a real resistance in a load and a real resistance in the impedance matching network,

5       $R_m = (R_L/\eta) - R_L$ .